

Title: Method of Printing

Description of Invention

This invention relates to a method of printing.

It is a requirement to be able to print on each article of a set of articles which are conveyed to a printing station in generally parallel lanes.

For example in a packaging line, a plurality of articles on each of which it is desired to print information, may be conveyed side by side on a conveying means, to a printing station where the information is to be printed.

So called intermittent printers are known in which a print head is moved relative to a stationary substrate whilst printing elements of the print head are actuated to print desired information on the substrate. Such printers may be thermal printers in which pixels of ink are removed from a ribbon as the printing elements are energised, and thus the print head, during printing, moves not only relative to the substrate, but relative to the ribbon too.

By virtue of the need to move the print head relative to the stationary substrate, the length of information which can be printed along the stationary substrate is restricted.

It is known to use an intermittent printer of the type described above, to achieve printing on each article of a set of articles which are conveyed side by side in generally parallel lanes to a printing station where the printer is located. The printer is mounted on a carriage and is bodily conveyed transversely across the lanes. The articles are maintained stationary at the printing station and the printer is conveyed transversely of the lanes to a first position where movement of the printer is stopped, and then printing is effected on a first of the articles by moving the print head within the stationary printing apparatus. The printer is then conveyed transversely of the lanes to a second position where movement of the printer is again stopped, so that printing may be effected on a second article, and so on for all of the articles of the set.

Although intermittent printers are not particularly fragile, the continual stopping and starting of the carriage creates wear and tear on the intermittent printer. The problem is aggravated because of the speed at which it necessary to convey the printer between stops in order to reduce the time between printing on the articles to a minimum. Thus not only is the printer subjected to jolts as the printer stops, but rapid accelerations when the printer is moved between stops. Also, the carriage and its ancillary drive system is subject to wear and tear aggravated by the start/stop motion of the printer.

So called continuous thermal printers are also known in which a print head is held stationary at a printing station and during printing, the substrate and ribbon are moved past the print head, usually together, whilst the printing elements of the print head are selectively energised, to effect printing. The length of print is not restricted as in an intermittent printer because the print head is not moved in the printer, but relative movement between the print head, and the ribbon and substrate, is achieved solely by movement of the ribbon and substrate. Such printers tend to be used where the substrate is a moving web, which can readily be moved together with the ribbon past the print head, whereas intermittent printers are more readily adaptable for printing on other substrates such as articles on a packaging line, because relative movement between the print head, and the ribbon and substrate, is achieved by print head movement.

According to one aspect of the invention we provide a method of printing information on each article of a set of articles arranged in generally parallel lanes, at a printing station, the method including continuously moving a printing apparatus relative to the lanes to bring the printing apparatus into registry with each article of the set in turn, and at each registry position, whilst continuing to move the printing apparatus, moving a print head of the apparatus relative to the respective article to a printing position in which the print head is capable of printing information on the article, continuing to move the printing

apparatus relative to the article whilst effecting printing with the print head, and when the information is printed, whilst continuing to move the printing apparatus, moving the print head out of the printing position.

Thus utilising the invention, it is unnecessary to arrest movement of the printing apparatus as the printing apparatus moves across the lanes of articles, but at each registry position, it is only necessary to move the print head within the printing apparatus to the printing position. Thus the problems mentioned above with using an intermittent type of printer in this context are largely overcome.

Preferably the printing apparatus is mounted on a carriage and the method includes continuously moving the carriage, preferably at a generally constant speed, transversely across the lanes, relative to a base structure relative to which each of the articles of the set is held stationary during printing. All of the articles of the set may be positioned at the printing station simultaneously whilst the printing apparatus is moved transversely across all the lanes, or the articles may be conveyed severally, e.g. in turn, in their respective lanes, to the printing station, provided that the articles each are present at the printing station so that the printing apparatus may be moved into registry with the articles and printing performed, whilst the printing apparatus is continuously moved.

The printing apparatus may include a housing mounted on the carriage, and print head movement to and from the printing position may be relative to the housing of the printing apparatus.

The print head may be of the kind having a plurality of printing elements which are selectively actuated during printing by a control means to effect printing of desired information on each of the articles. The information printed may be the same for each of the articles, or different for at least one of the articles compared with the other articles.

In one embodiment the printing apparatus is a thermal printer in which there are printing elements arranged in a generally linear array along the print

According to a second aspect of the invention we provide a method of printing information on each article of a set of articles arranged in generally

parallel lanes, at a printing station, the method including continuously moving a printing apparatus relative to the lanes to bring the printing apparatus into registry with each article of the set in turn, the printing apparatus including a print head and a carrier for marking medium which is applied to the articles during printing, and at each registry position, whilst continuing to move the printing apparatus, effecting printing with the print head, and when the information is printed, continuing to move the printing apparatus to the next registry position.

The invention may be applied to a thermal print head in which printing elements are selectively energised during printing to melt and remove pixels of marking medium from the carrier and deposit the pixels of ink on to the articles. Alternatively, the invention may be applied to an alternative kind of printer, such as an ink jet type printer in which the marking medium is contained in a reservoir and selectively applied by jetting, onto the articles to print the information.

The method of the second aspect of the invention may have any of the features of the method of the first aspect of the invention.

According to a third aspect of the invention we provide a printing station for performing the method of the first or second aspect of the invention, the printing station including a carriage, a printing apparatus, means to mount the printing apparatus on the carriage, means to move the carriage and thus the printing apparatus transversely of a plurality of lanes and to effect printing on each of a plurality of articles at the printing station, each of the articles being located in one of the lanes, characterised in that the means to move the carriage is adapted to move the carriage substantially continuously across the lanes and the printing apparatus being adapted to print the information on each of the articles of the set in turn without or substantially without stopping.

In one embodiment, the carriage may be mounted on a gantry which extends over or under the lanes and the printing apparatus is moved over or under the lanes respectively, on the carriage.

The gantry and/or the carriage may include a drive means for moving the carriage, as desired. Movement of the carriage may be controlled by a control means which co-ordinates printing with carriage movement.

The invention will now be described with reference to the accompanying drawings in which:-

FIGURE 1 is a side illustrative view of a printing station which may be operated in accordance with the invention, at the commencement of printing on each article of a set of articles;

FIGURE 2 is an illustrative plan view of the printing station of figure 1 but after printing.

Referring to the drawings, a printing station 10 is located adjacent a conveying means 12 e.g. of a packaging line, the conveying means 12 being arranged to convey sets of articles, two of which are shown at 14a to 14e and 15a to 15e, to and from i.e. past the printing station 10, with the articles arranged in generally parallel lanes a to e. Thus the articles of a set, e.g. articles 14a to 14e are, at the printing station 12, side by side. In this example, the articles 14a to 14e of the set all arrive at the printing station 10 together, although they may arrive severally, provided that each article 14a to 14e is present at the printing station 10 prior to a printing apparatus 16 being moved as hereinafter described, into registry with the articles, for printing.

In the example illustrated, the conveying means 12 is a belt or roller conveyor on which the articles 14a to 14e and 15a to 15e are moved relative to a base structure 21, but the invention may be utilised with other kinds of conveyor which are adapted to deliver a set of articles in lanes to a printing station 10.

As shown, the printing station 10 includes a gantry 18 mounted on the base structure 21 relative to which the conveying means 12 conveys the articles 14a to 14e and 15a to 15e, the gantry 18 having upstanding supports 19 at either side of the conveying means 12, and a generally horizontal rail part 20 although any other construction, e.g. a suspended construction, may be used to provide a rail or the like along which a carriage 22 carrying the printing apparatus 16 may be provided.

The carriage 22 is in this example suspended from the gantry rail part 20, but may be mounted on the rail part 20, or the rail part may be arranged to pass through the carriage 22 as desired. The carriage 22 has wheels or rollers 24 which ride on the rail part 20 to facilitate carriage 22 movement along the rail part 20. The carriage 22 in this example includes a drive means (not shown) which applies drive, through a suitable transmission (not shown) to the wheels or rollers 24 to effect carriage 22 movement along the rail part 20 transversely of the lanes a to e of articles 14a to 14e and 15a to 15e. In another embodiment, the carriage 22 may be driven by an external drive means, such as a motor connected by cables to the carriage 22, or by a lead screw with which a threaded member of the carriage 22 co-operates.

The requirement is for the carriage 22 to be moveable transversely of a set of articles 14a to 14e positioned at the printing station 10, preferably in a continuous or substantially continuous movement as hereinafter described.

The carriage 22 is fixed relative to the print apparatus 16, and the printing apparatus (16) includes a housing 25 in which is contained a print head 26 which in this example is a thermal print head 26 having a linear array 27 of thermal printing elements 28 each of which may selectively be energised under the control of a control means 30, such as computer, to remove pixels of marking medium such as a thermoplastic ink, from a carrier ribbon 31, as the print head 26 and ribbon 31 are relatively moved, and to deposit the ink onto an adjacent article.

The ribbon 31 is provided on a supply spool 32 mounted in the housing 25, and is wound on to a take-up spool 33 in use. In this example, the take-up spool 33 is driven from its own motive means 34 e.g. via a belt 35 or gear drive. In another example, the take -up spool may be driven from the drive means of the carriage 22.

The ribbon 31 is located between the print head 26 and an article 14a to 14b of the set of articles onto which information is to be printed, and the print head 26 is movable by a motive means (not shown) for movement towards and away from the articles 14a to 14e as indicated in figure 1 by the arrow A. When moved towards an article 14a to 14e, as seen in figure 1, to a printing position, the ribbon 31 is urged into contact with the article and as the printing elements 27 are selectively energised, the ink is melted and transferred from the ribbon 31 on to the article. When the print head 26 is moved away from the article out of the printing position, relative movement occurs between the print head 26 and the article 14a to 14e without any ink being removed from the ribbon and deposited on to an article, as the ribbon will be out of contact with the article, and typically out of contact with the print head 26 too.

^{Sub 67} The control means 30 in this example is connected to the printing apparatus 16, and to the drive means of the carriage 22 is desired, via a travelling lead 35, as is well known in the art, although the control means 30 or part of the control means may be mounted in or on the printing apparatus 16 or carriage 22 as desired.

A method in accordance with the invention will now be described.

A set of articles, 14a to 14e are conveyed by the conveying means 12 to the printing station 10, where they are held stationary. This may be achieved by the control means 30 co-ordinating article movement to stop the conveying means 12 when the articles 12a are in the positions shown in figure 1, or else some physical barrier may be moved into the path of the articles 14a to 14e to arrest further movement of the articles 14a to 14e.

The carriage 22 and printing apparatus 16 are then moved transversely of the lanes a to e of the articles 14a to 14e with the print head 26 moved out of the printing position. When the printing apparatus 16 has been moved to a position in registry with a first article 14a of the set of articles such that the print head 16 is positioned over a part of the article where it is desired to print information, the print head 26 is moved towards the article 14a into the printing position as seen in figure 1, with the ribbon 31 urged into contact with the article 14a between the print head 16 and the article 14a, while movement of the carriage 22 and printing apparatus 16 across the lanes a to e continues.

Printing of the information on the article 14a may then be commenced. The ribbon 31 will need to be moved by its motive means 34 relative to the print head 16 during printing. Such ribbon 31 movement may be at a speed such that the ribbon 31 and article 14a are or are not relatively moving, as desired to achieve a required quality of print. The printing elements 28 will selectively be energised as the carriage 22 and print head 16 continues to move transversely of the lanes a to e to print the desired information. When the information has been printed, the print head 16 is moved away from the article, again while print head 16 and carriage 22 movement transversely of the lanes a to e continues. Preferably ribbon 31 movement relative to the print head 16 is arrested so as not to waste ribbon 31.

The method is repeated as the printing apparatus 16 is moved into registry with a second 14b of the articles 14a to 14e, and then for each of the remaining articles 14c to 14e.

All the time, the printing apparatus 16 and carriage 22 continue to move transversely of the lanes a to e such that there is no requirement to stop the printing apparatus 16 until information has been printed on all of the articles 14a to 14e of the set.

When the printing apparatus 16 has printed on the last article 14e of the set, the conveying means 12 may be operated, or any physical barrier present

removed, to permit the articles 14a to 14e all to be conveyed in their lanes a to e beyond the printing station 10 as illustrated in figure 2, so that the next set of articles 15a to 15e may be conveyed to the printing station 10 for printing. If desired, as the next set of articles 15a to 15e are conveyed to the printing station 10, the printing apparatus 16 and carriage 22 may be moved back across the lanes a to e ready to print on the first article 15a of the next set, in the first lane a. Alternatively, the information may be printed on each of the next set of articles 15a to 15e in a reverse order as the printing apparatus 16 and carriage 22 are moved transversely of the lanes a to e in an opposite direction to the direction of movement of the printing apparatus 16 and carriage 22 during printing on the articles 14a to 14e of the previous set. In each case though, it is necessary to move the ribbon 31 relative to the print head 26 during printing so that fresh ribbon 31 from which pixels of ink have not already been removed, is continually presented between the print head 26 and the articles on which information is to be printed.

Various modifications in addition to those already mentioned may be made without departing from the scope of the invention. For example, as described the invention has been applied to a printing apparatus of the thermal kind, although may be applied to any other printing apparatus, such as an ink jet or other pixel based printing apparatus, as desired. Thus in such an alternative arrangement, a carrier ribbon for ink may not be required, but the ink may be contained in a carrier reservoir from which it is fed to printing elements or jets of the print head for jetting on to the articles during printing. The invention may be applied to other pixel based and non pixel based systems as desired.

Although in the drawings, a conveying means 12 for conveying a set of five articles is indicated, of course the set of articles may be any plurality of articles in a corresponding number of lanes.

The features disclosed in the foregoing description, or the following claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, as appropriate, may, separately, or in any combination of such features, be utilised for realising the invention in diverse forms thereof.